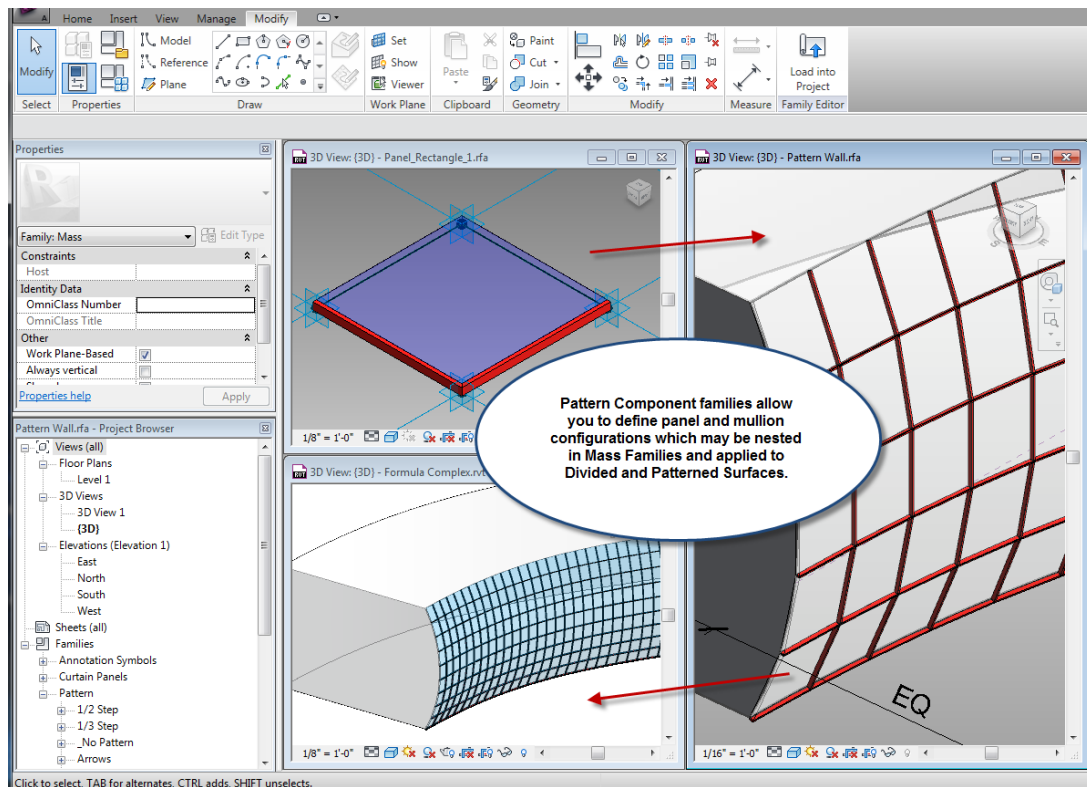


AGENDA:

1. Creating Pattern Component Families
2. Applying and Modifying Pattern Component Families

1. Pattern Component Families

The Curtain Panel by Pattern family template allows you to generate 3D geometry in Pattern Component Families, to define panels and mullions which can be loaded into a Conceptual Mass family and applied to divided and patterned surfaces. This allows you continue the surface rationalization process and populate your mass with buildable components.

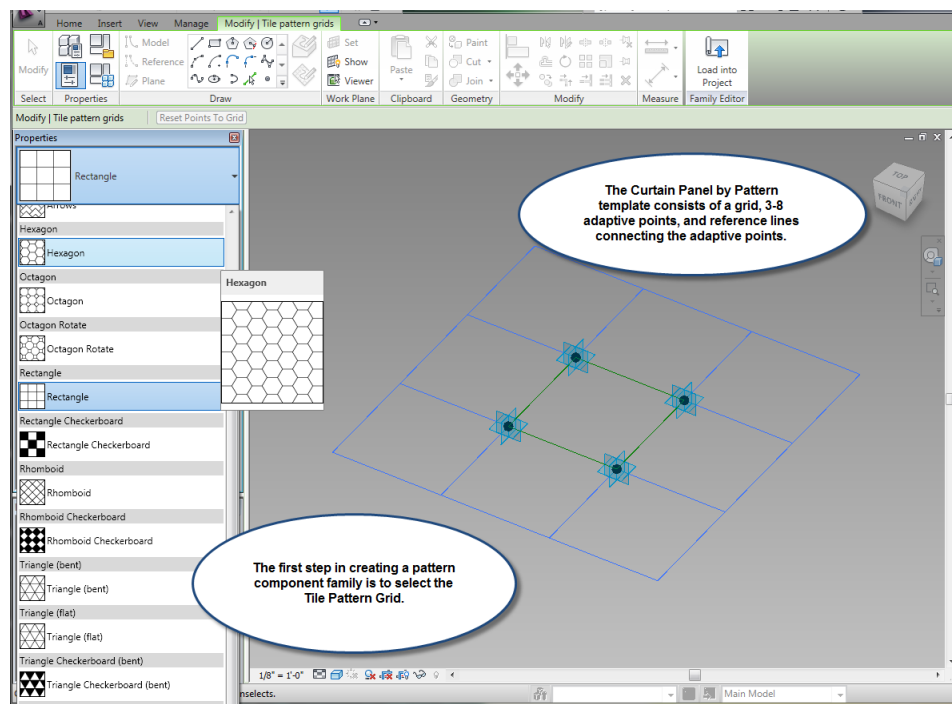


Pattern Component families are nested into Conceptual Masses which are in turn loaded into the Project environment. It is possible to select and modify individual panels while the mass is still in the Family Editor. This would allow you to swap different panels or assign different instance parameters to individual panels.

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To Create and Apply Pattern Component family you will follow a six step process:

1. Create a new family using the Curtain Panel by Pattern template.
2. Determine the Tile Pattern
3. Model the panels and/ or mullions using Create Form tools
4. Load the pattern component family into your Conceptual Mass family
5. Apply the pattern component family to a divided or patterned surface on the mass
6. Modify the pattern component family as required

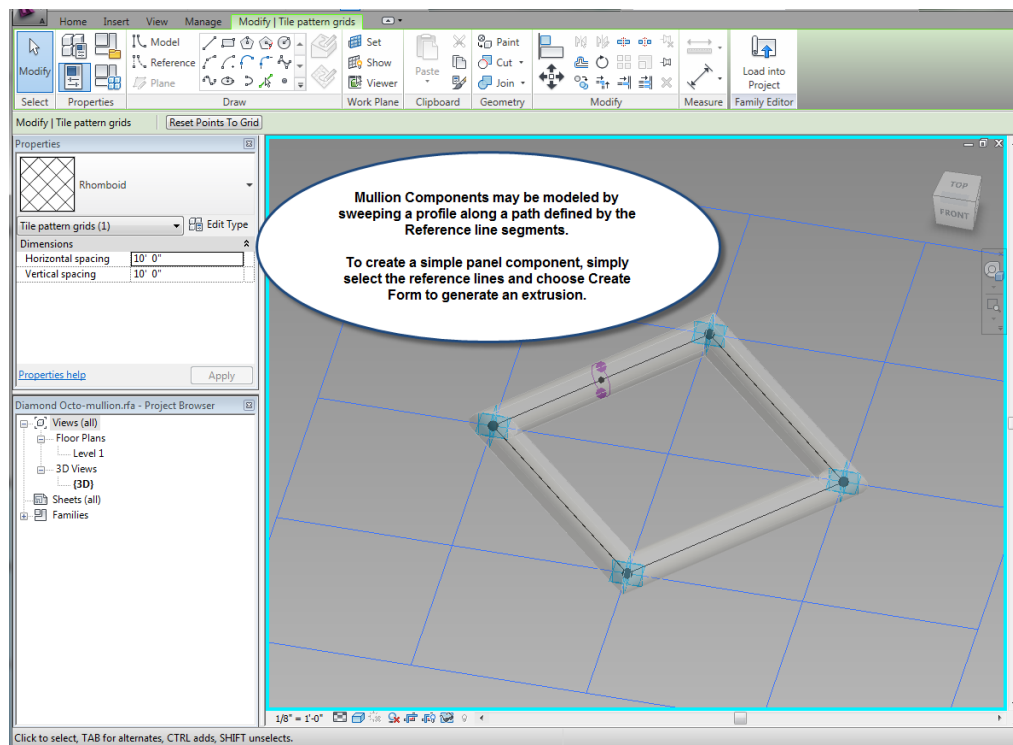


The Curtain panel by pattern template contains a rectangular Grid, a series of adaptive reference points, and a set of reference lines which connect the adaptive points and describe the shape of the pattern. The reference points are restricted to the grid horizontally but may be moved up or down. This allows the pattern components to be flexible when applied to curved surfaces but still maintain the basic shape as defined in the 2D pattern.

To set the Pattern for your new component family, pick the grid and in the type selector, choose the desired Pattern. These are the same pattern shapes which are displayed in the conceptual mass family when you divide a surface and then apply a pattern.

The pattern component family template includes a single floor plan view for Level 1 and a single 3D view. There are no elevation views but you can set the 3D view to any direction including side views if necessary.

The 3D geometry for a Pattern component family is generated in a similar fashion to that for a Conceptual mass family. You sketch 2D shapes and then use the Create Form tool to generate sweeps, lofts, extrusions, blends, etc.

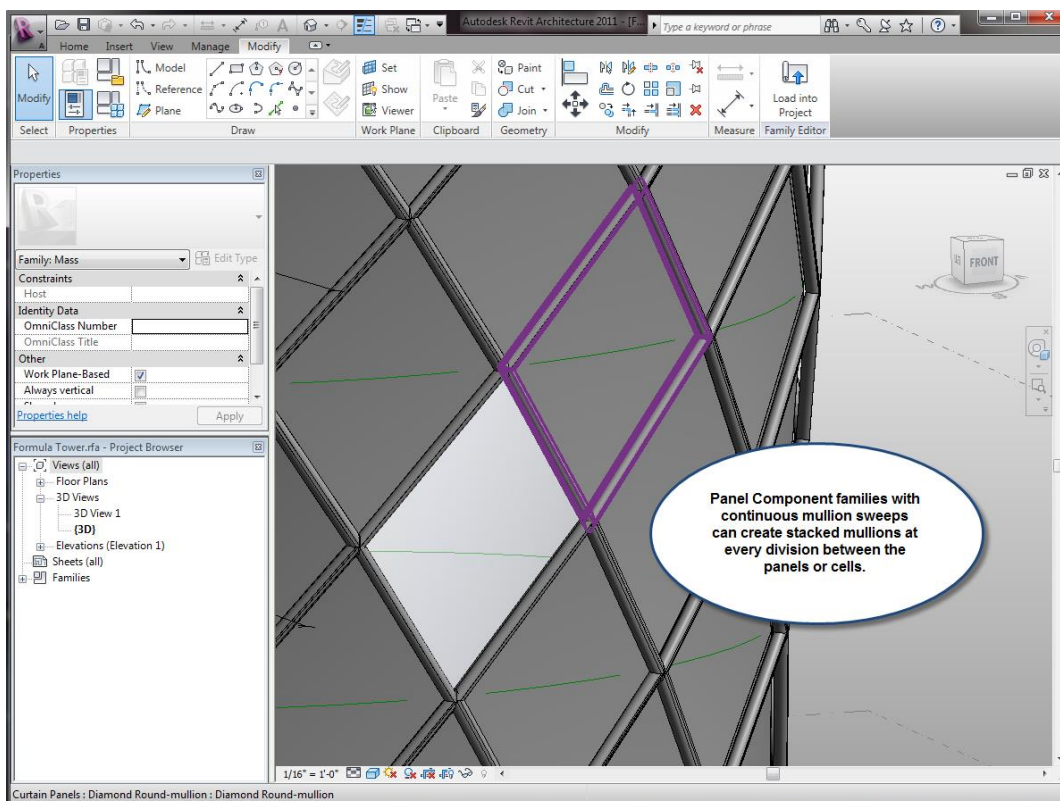


A simple panel extrusion may be created by selecting the reference lines which define the pattern shape and then choosing Create Form. You will have the option of generating a planar surface or a solid extrusion.

As adjacent panels are arrayed along curved surfaces, gaps on convex faces and overlaps on concave surfaces will appear as the extrusion will be perpendicular to its profile. To create a thick panel with edges which do not gap or overlap along curved surfaces, create Blend with two profiles instead of an extrusion. Add new reference points which will be hosted by the existing reference points and parameterize their height with a level offset.

Mullions may be created by drawing a profile to sweep along the reference lines. It is helpful to add a reference point at the middle of one of the reference lines and then set its plane as the active work plane when sketching your profile. When you sweep a profile along the reference lines, the profile can be centred on the path, or offset in any direction. If the profile extends below the grid plane, the resulting mullions will be embedded in the face of the mass.

When you create mullion sweeps in your pattern component families, it is not necessary to create a full, closed sweep around the entire perimeter. If you do, the common edges of the panel will be stacked, or overlapped with the edges of the adjacent panel.

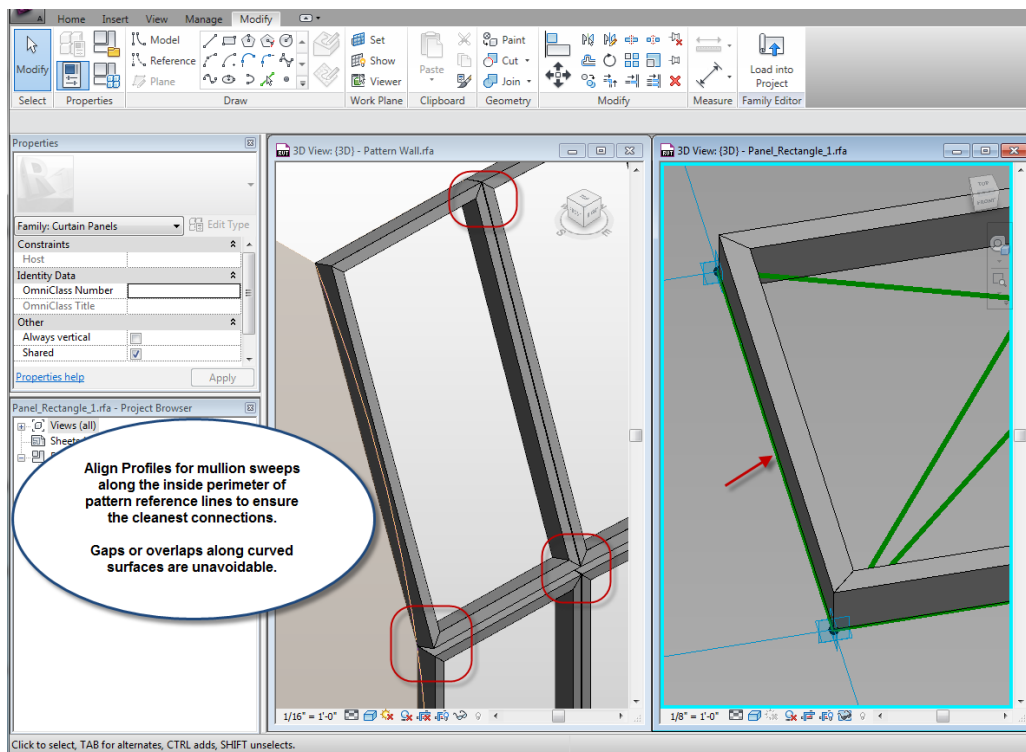


There are a couple of potential solutions for the overlapping mullions issue. You can extrude the mullion around only $\frac{1}{2}$ of the panel or you can position the profiles for the sweeps along the interior side of the reference lines.

Creating a sweep around one half of the mullion perimeter works best when the profile's width is centred on the reference line path.

Aligning profiles to the inside of the pattern perimeter reference lines will create a doubled effect with the each division showing two adjacent mullions.

Regardless of which method you use, there will always be some issues along curved surfaces. The frames, created as straight segments, will open along adjacent edges on convex curves as shown in the image below. On concave curves adjacent frames will begin to overlap each other.

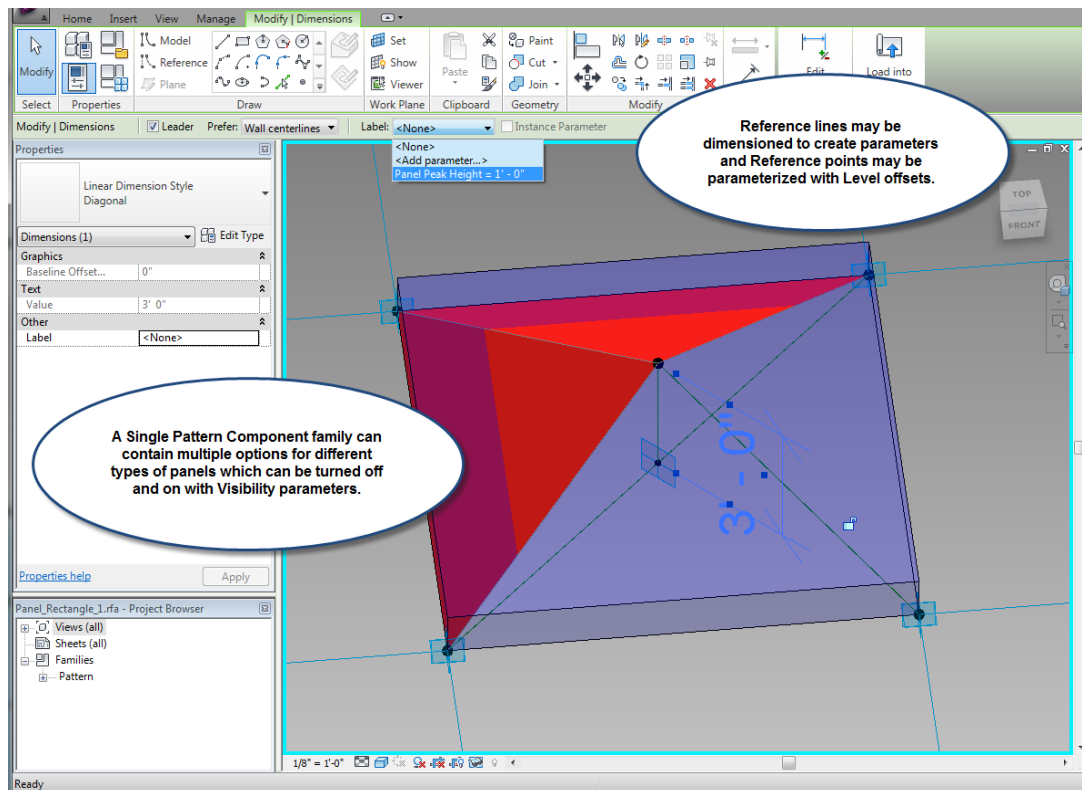


Rectangular patterns, are usually the easiest to use with regards to reducing the number of conflicts at panel edges.

Try to use the Empty or Overhanging Border tile setting and then adjust the Divided surface to reduce the size of gaps at the edges. Using the Partial setting will trim components that would otherwise overhang the surface edges.

When testing variations in your panel geometry it can be very helpful to use a Tiled layout of windows. This makes it much easier to view the results in the conceptual mass family while continuing to work in the pattern component family in an adjacent window.

Complex panels can be modeled by creating additional reference lines and reference points to define a skeleton for the panel form. A pyramid style panel can be generated by adding a diagonal reference line across the extents of the pattern, a reference point at the diagonal line's midpoint, and then either a hosted point or a vertical reference line to define the peak location. Add more reference lines to create enough edges to define the faces of the pyramid.



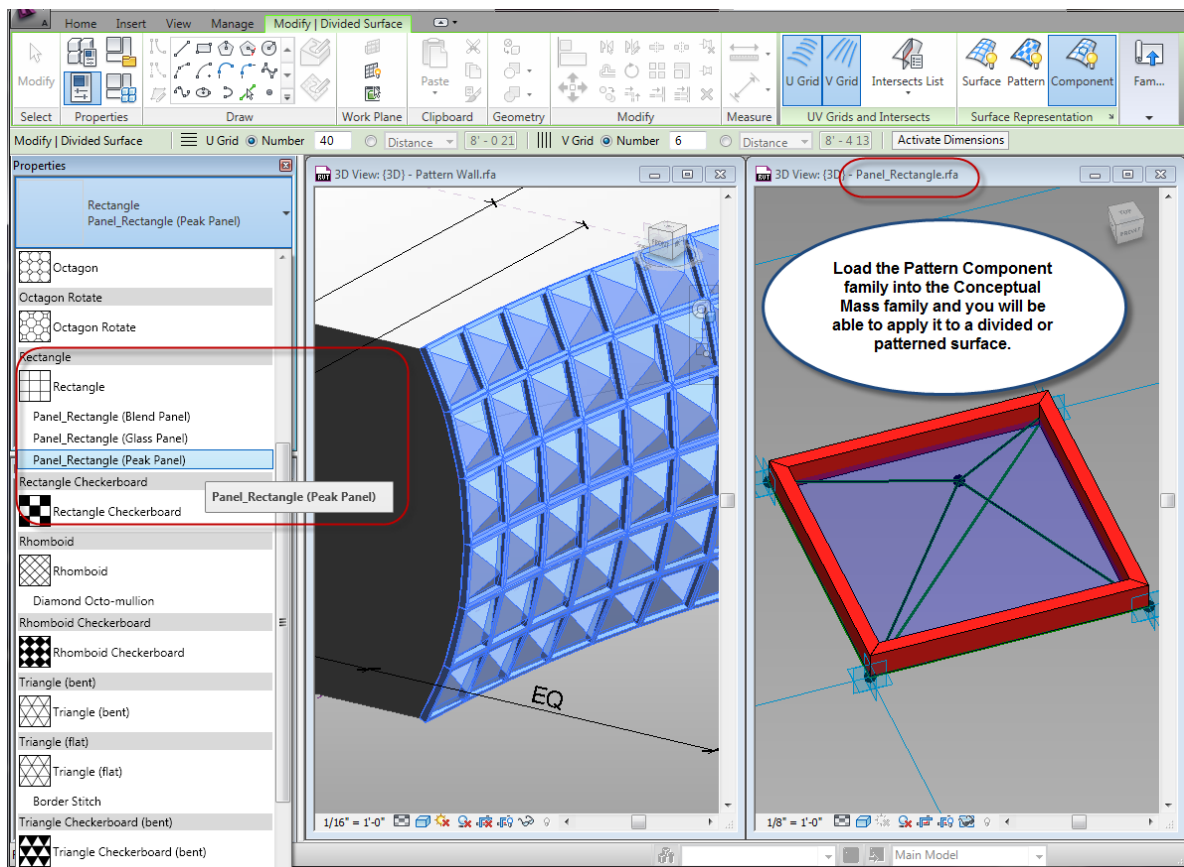
To create a lofted blend type of a panel, place additional points along a center axis defining the trajectory of the loft. Create as many profiles as required and host them on the points.

The Temporary visibility controls are very useful for hiding elements in the Family editor. This is especially important when you create multiple panel types in a single family.

Multiple component options may be created inside a single family. Assign Visibility parameters to the geometry for different panels. The visibility parameters can be named to describe the option you wish to display as in "Glass Panel Visible" or "Peak Panel Visible". These parameters may be saved as either Type or Instance parameters.

2. Applying and Modifying a Pattern Component Family

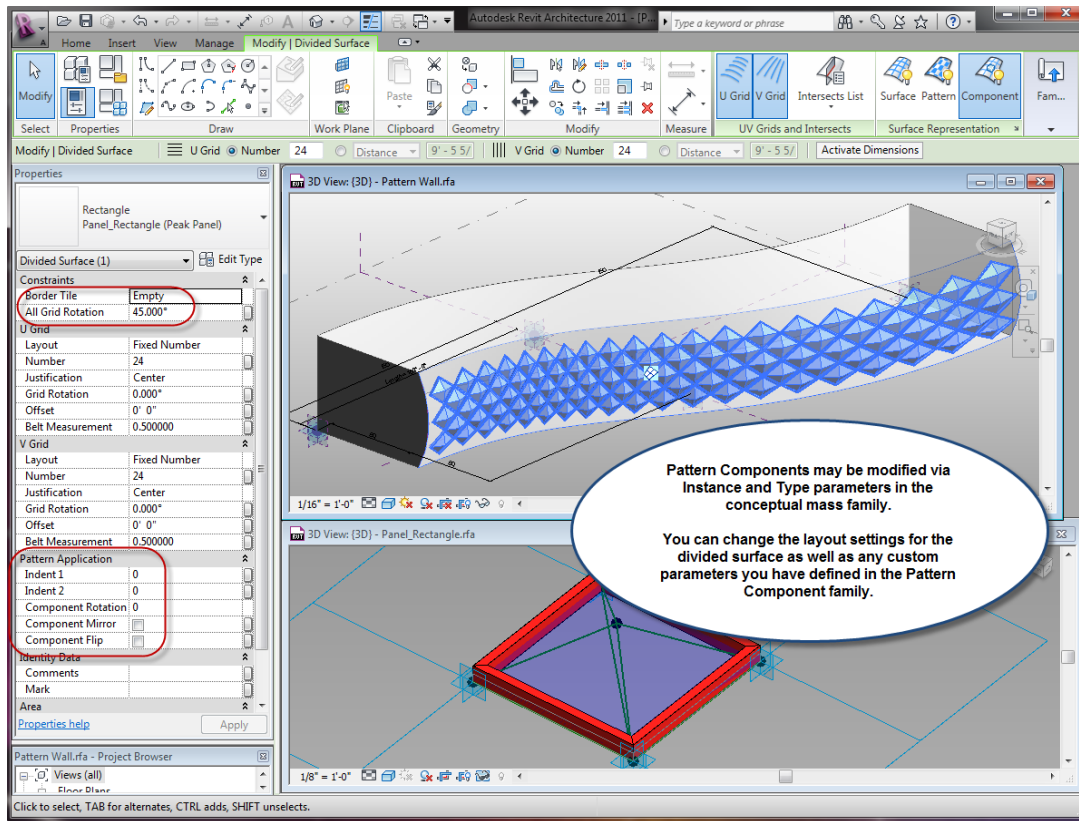
Before you can apply a Pattern Component family, you need to load it into the conceptual mass family. Open both files and then from within the Pattern component family, choose Load into Project. If additional files are open, a dialog box will appear allowing you to choose which files into which to load the pattern component family.



After loading the pattern component family into the conceptual mass family, you can select any divided or patterned surface on the mass and choose the new pattern component family from the type selector. The component family types will be listed below the 2D pattern type on which you initially developed the geometry.

Pattern components can take a bit of time to regenerate when they are first applied and then again whenever you make a change to the layout or to the pattern family properties.

Pattern component families can be modified after being applied to a divided surface in the Mass family. Selecting the pattern component will display all of the typical layout modification tools allowing you to adjust the size and number of panels as well as their orientation.

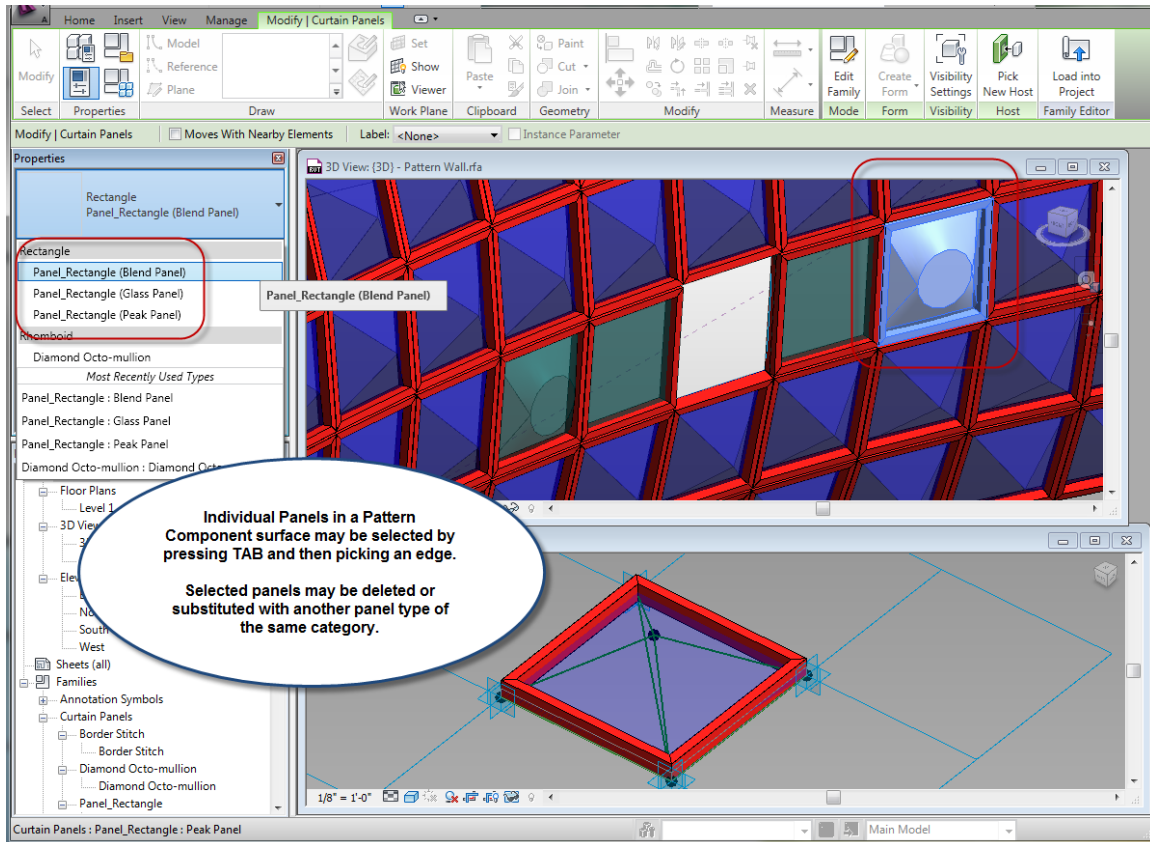


Occasionally, the Pattern Application will need to be adjusted with regards to its orientation. Raised panels may be inverted on the surface with the panels pointing into the model instead of out from the surface. If this occurs, use the Component Flip option to reverse the application.

The Indent settings allow you to shift the pattern by a certain number of divisions in either the U or V directions. Component Rotation allows you to spin the pattern component in 90 degree increments within its pattern cell. Component Mirror will reflect the pattern component along the U grid.

If you have parameterized any dimensions within a component family such as the thickness of a flat panel, or the peak height of more complex panel, you will be able to modify these custom parameters in either the Type or Instance properties.

Individual cells or instances of pattern components may be selected using a Tab Selection technique. Selected panels may then be deleted or swapped for other panel types.



To swap a panel type, you need to have another pattern component family which uses the same shape of grid as the selected panel. Tab select one or more pattern cells and then choose a new pattern component from the Type selector.

It is also possible to swap a panel to another type saved within the same pattern component family. This will require the use of visibility parameters assigned to the geometry of the different panel options. Visibility parameters may be saved as either Instance or Type parameters but setting them as Type parameters and then creating multiple named types within the component pattern family is the most convenient means of managing the display of the panel types.

If you have partial cells along the perimeter of your divided surface, you can pick the pattern component, right-click and then choose select All, All Interior, or All Border components.

Exercise Notes

- In the following exercise you will learn how to create and apply Pattern component families with custom mullions, multiple panel types, and visibility settings.
1. Open Revit and start a new, Conceptual mass family with the Mass.rft template. To get started, we will create simple Sweep to represent a four-story building. Add 4 reference points in the four quadrants of Level 1. Align the points with each other and add a few dimensions to equalize the points about the Center reference planes and set the overall extents to 80 feet by 240 feet.
 2. Pick Reference, and then spline. Create a smooth spline by picking the four reference points. The spline should intersect the origin at its midpoint.
 3. Set the vertical reference plane at one end of the spline current and add a rectangle 60 feet wide by 48 foot high. Tab select the outer vertical line and delete it. Add a start end radius arc and set the radius to 48 feet. Select the spline and the profile and pick Create Form.
 4. Select the curved surface of the mass and choose Divide face. We have a 48 foot tall face which could house 4 floors at 12 feet between each. To get a feel for that division, set the layout to fixed distance with 12 feet in both the U and V directions. To eliminate the partial cells at the border, change the layout type to Number by picking it on the Options bar.
 5. This grid division will be too coarse to maintain smooth curves but could still be used for previewing our overall grid before going to the final resolution. Pick the curved surface and set the Layout type to Distance and 6 feet in both directions. To eliminate the partial cells at the border we can specify our fixed distance as either minimum or maximum distance. This can affect the number of divisions. Set both values to Maximum and apply. 43 x 9 divisions. Set the value to Minimum distance to get 42x8 divisions which gives us a better number to divide into our 48 foot height.
 6. For our first tests we can Divide the end surface of the sweep and try our pattern component on an even smaller number of panels. Set the end division to 12 feet by 12 feet. Working with a large number of panels while testing can involve long waits for regeneration.
 7. Set a SW isometric view current and zoom in on the test face of the mass. Save the conceptual mass family as Pattern Wall.

8. Start a new family with the Curtain Panel Pattern Based template. Select the tile pattern grid and in the properties palette, set the horizontal and vertical distances to 12 feet. Adjusting this size allows you to preview the geometry for the panels at their intended relative sizes. Reduce the distances to 6 feet to match our intended finished size for the surface.
9. Select the grid again and in the Type selector preview the different patterns such as rhomboid, octagon, etc. and then set it back to rectangle. Save the file as Rectangle_Triple_Panel.
10. Select one of the reference points and view its instance properties. This is an adaptive reference point which will move vertically when attached to grid divisions on a curved surface. Drag the adaptive points up or down from the grid. Pick the grid and from the Options bar, choose Reset Points to Grid.
11. If your Thin Line toggle is disabled, you should be able to see the four reference lines connecting the adaptive points. Pick one of the reference lines and the entire chain should highlight. Pick Create Form and select the solid extrusion option. Pick the temporary dimension and set the height to 6". Select the extrusion and change the Positive offset distance in the constraints to 8" and Apply.
12. We can use parameters to control the properties for the panel. Pick the associate parameter button beside the Positive offset value. Pick Add Parameter and create a Type parameter called Panel Thickness.
13. Add an Instance material parameter using the associate parameter button beside Material. Name the parameter "Glass Panel Material". Open the family types dialog and assign a material to the material parameter. Create a Glass-blue material by duplicating the default glass material and setting the transparency to 35%. Apply the material change. Test the panel thickness parameter to ensure that it flexes properly by reducing in to 4 inches and then close the family types dialog.
14. Save the pattern component family and then pick Load into project. Select the divided surface on the end wall and in the type selector, choose the new Triple Panel family. Pick Edit type and try adjusting the Panel thickness to 12" and then back to 3 inches.

15. From the View tab on the ribbon, choose the Tile option. This will allow you to display the component family and the mass family in adjacent windows. Pick in the panel family window to set it current. Tab select the extrusion and then pick the associate parameter button for the Visible field in the Graphics settings. Add a type parameter called Glass Panel and group it under the Construction heading. Create two more Visible, Type parameters in the same category and call them Blend Panel and Peak Panel. Select the Glass Panel parameter in the Associate Family Parameter dialog and pick Ok.
16. Select the extruded form and use the Temporary Hide/Isolate settings to Hide Element. Add a reference point to the middle of one of the reference lines. Pick the reference point and then start the rectangle tool. Start the rectangle at the point and draw it up and in about 6" x 12".
17. Set the view scale to 1"=1'-0" and then add two dimensions to the rectangle. Label the dimensions as Mullion_Width and Mullion_Depth, to create two more type parameters grouped under the Dimensions category along with the Panel Thickness. In the family types dialog flex the Mullion dimensions and set them 3 inches x 6 inches.
18. Pick the rectangle and then the chain of reference lines and pick Create Form. Select the Sweep and associate a Visibility parameter called Mullions. Create it on the fly and set it to Type, grouped below the Construction category. This will allow us toggle the mullions off and on in the conceptual mass family.
19. Add a Material parameter to the material setting and call it Mullion Material. Open the family types dialog and then create a material to use for the mullions. Pick any color but something that contrasts with the blue panel color will be easiest to work with initially. Create a new Type called Glass Panel. Set the mullions to 3" x 8" and enable the Glass Panel and mullions options in the Construction category.
20. Pick Load into Project. Select the component surface and pick the new Glass Panel family type. The mullions look quite small relative to the oversize 12 foot divisions. Change the layout minimum distances to 6 feet x 6 feet. Zoom in around the curved edge and toggle the Border Tile setting from Partial, to Empty, to Overhanging and then back to Partial. Obviously the curved edge is going to require some custom work but we will cover this in the next lesson on "Adaptive Components".
21. With the component surface still selected, open the Edit Type dialog and experiment with toggling the visibility of the panel and mullion components as well as modifying the dimension for both components. Switch back to the component window.

22. Select the mullion form and use the Hide element tool to get it out of the way while we model a couple of alternate panels. Pick the Reference tool, turn on 3D snapping, turn off Chain, and add a diagonal reference line between the points at opposite corners. Try dragging the adaptive points off the grid to see them drag the reference line with them. Pick the tile grid and choose Reset points to grid on the Options bar.
23. Add a reference point at the middle of the diagonal reference line. Select the reference point to make it the active work plane and then add a vertical reference line starting at the point and extending up about 4 feet. Pick the two lock icons to constrain the lower end of the reference line. Pick the reference line and convert its temporary dimension to permanent. Select the dimension and add a Type parameter called Panel Height. Try flexing the parameter to ensure the bottom end is constrained and the height adjusts correctly.
24. Pick the Reference tool, enable 3D snapping and Chain options and then add four diagonal reference lines between the corners and the top of the Panel Height line. We are going to create 4 triangular, planar surfaces by selecting three reference lines at a time and choosing Create From with the surface option. Use Tab to cycle selections and CTRL to add the lines. Repeat until the four sides of the “pyramid” are closed in.
25. Select the four faces of the pyramid and associate the visibility parameter Peak Panel with the geometry. Add a new material Type parameter called Peak Panel material. Open the family types dialog and create a new Glass_Green material for the new material parameter.
26. Still in the Family types dialog, try flexing the Panel Height parameter to confirm it drives the size of the pyramid’s height. Create a new Type called Peak Panel. Under Construction, disable the Glass Panel and enable the Peak Panel. Pick Apply and then try switching between the two types to confirm that the correct construction options are enabled. Create a third family type called Blend Panel and associate its construction visibility option with the Blend Panel selection. Test-switch the three types and pick OK.
27. Pick the four surfaces of the pyramid and choose Hide element. Note the appearance of the new reference point at the top of the vertical reference line. Pick this point to make it active and add a reference circle with its center on the point. Set the radius to about 2 feet and then convert the temporary dimension to permanent. Add a label to the dim and call it Panel Top Radius.

28. Pick the Circle and the four perimeter reference lines and then choose Create Form. Select the form and assign the Blend Panel visibility parameter. Assign the Peak Panel material parameter or create a new material parameter called Blend Panel material.
29. Open the family types dialog and try flexing the height of the panel and the radius of the top of the loft. Confirm the three types are still set to display the correct options and pick Ok.
30. *Before we reload the modified component family into the conceptual mass, take a look in the Project Browser under Families. If the file name is listed under Curtain Panels, delete the family. This can prevent an error message about duplicate family names when trying to load the modified component family back into the conceptual mass family.*
31. Load the component family into the conceptual mass family. Select the component surface and try changing it to the 3 available panel types. First glass panel, then peak panel, and then blend panel. Note how the cutoff panels along the curved border are distorted and truncated. Pick the component surface, right-click and choose Select All Border components. With the partial panels selected, change the type selector to Glass Panel.
32. Set the end face back to a regular Rectangle surface pattern. Adjust your view and select the curved surface and then assign the Peak Panel. It might take a few seconds to regenerate as there are over 330 panels on this wall.
33. Zoom in to one end and press Tab to select a single panel. Press CTRL and pick a few more individual panels and then switch their type to glass panel.
34. Continue to experiment with the Type parameters to flex the dimensions of the components, toggle visibility, and adjust materials.
35. Save and close both files. In the next class we will take a closer look at dealing with border conditions and creating custom adaptive components.